

Indiana University – Purdue University Fort Wayne
Opus: Research & Creativity at IPFW

Computer and Electrical Engineering Technology &
Information Systems and Technology Senior Design
Projects

School of Engineering, Technology and Computer
Science Design Projects

4-27-2005

Collision Detector Sensor Using an Ultrasonic Rangefinder

Wyatt Wooten

Indiana University - Purdue University Fort Wayne, wootdm01@ipfw.edu

Follow this and additional works at: http://opus.ipfw.edu/etcs_seniorproj



Part of the [Computer Sciences Commons](#), and the [Engineering Commons](#)

Opus Citation

Wyatt Wooten (2005). Collision Detector Sensor Using an Ultrasonic Rangefinder.
http://opus.ipfw.edu/etcs_seniorproj/5

This Senior Design Project is brought to you for free and open access by the School of Engineering, Technology and Computer Science Design Projects at Opus: Research & Creativity at IPFW. It has been accepted for inclusion in Computer and Electrical Engineering Technology & Information Systems and Technology Senior Design Projects by an authorized administrator of Opus: Research & Creativity at IPFW. For more information, please contact admin@lib.ipfw.edu.

Collision Detection Sensor Using an Ultrasonic Rangefinder: A Design Report

by

Wyatt Wooten

April 27, 2005

ECET 491, Senior Design: Phase 2
Professor Paul Lin
Indiana University-Purdue University
Fort Wayne, Indiana

EXECUTIVE SUMMARY

Distracted driving is becoming a greater cause of automobile accidents. As a result, insurance premiums are increasing. Currently, there is not a device that will indicate how closely a car is following before an accident occurs.

A collision detection sensor has been designed by adapting an ultrasonic rangefinder. In finding a good use for the rangefinder, the idea for using it in automobiles was discovered. The collision detection sensor has a Silicon Laboratories microcontroller for functionality. It also has a receiving circuit, a transmitting circuit, and a LCD display.

There are several environmental variables to consider when implementing the collision detection sensor. The ultrasonic rangefinder will need to be modified to become more useful in a real-world situation. The noisy environment of car travel, as well as the weak signal returned to the rangefinder makes its application difficult in its current configuration.

The noisy environment and weak return signal make the application of this device difficult. However, the collision detection sensor will implement digital signal processing to filter the noise and strengthen the return signal.

TABLE OF CONTENTS

| | |
|--|----|
| EXECUTIVE SUMMARY | i |
| LIST OF ILLUSTRATIONS | iv |
| PREFACE | v |
| CHAPTER I INTRODUCTION | 1 |
| Problem Topic | 1 |
| Background | 2 |
| Criteria & Parameters..... | 2 |
| Methodology | 2 |
| Primary Purpose | 3 |
| Overview | 3 |
| CHAPTER II SENSOR DESIGN OVERVIEW | 4 |
| CHAPTER III HARDWARE SPECIFICATION | 6 |
| Transmitting Circuit | 6 |
| Receiving Circuit..... | 7 |
| LCD Display | 8 |
| LED Sensor | 8 |
| Silicon Laboratories Microcontroller | 8 |
| CHAPTER IV SOFTWARE SPECIFICATION | 11 |
| Main Method | 11 |
| Distance Measurement | 13 |
| Speed Measurement | 14 |
| Display Data..... | 14 |
| CHAPTER V DESIGN PROCESS..... | 16 |
| CONCLUSION | 20 |
| REFERENCES..... | 21 |
| APPENDIX: SOFTWARE CODE..... | 22 |

LIST OF ILLUSTRATIONS

| <u>Figure</u> | <u>Page</u> |
|---|--------------------|
| 1 Block Diagram of Design..... | 5 |
| 2 Hardware Schematic of Transmitting Circuit | 7 |
| 3 Hardware Schematic of Transmitting Circuit | 8 |
| 4 Block Diagram of Silicon Laboratories Microcontroller | 10 |
| 5 Pin assignments for the Crossbar Registers | 12 |
| 6 Priority Crossbar Decode Table | 12 |
| 7 A Portion of the LCD's Font Table..... | 15 |
| 8 Waveform of Simulated Transmitting Microcontroller Signal | 17 |
| 9 Waveform of Simulated Transmitted Signal..... | 18 |
| 10 Waveform of Simulated Receiving Signal..... | 19 |